PATENT ABSTRACTS OF JAPAN

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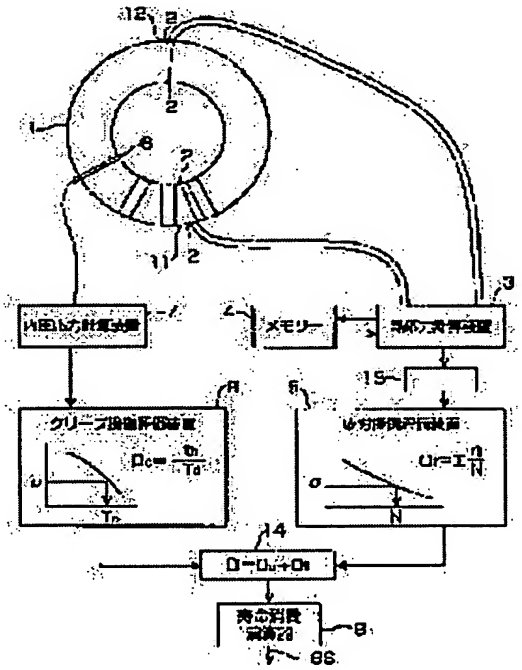
(71)Applicant : **MITSUBISHI HEAVY IND LTD**
(72)Inventor : **TANAKA YASUYUKI**
TOKIYOSHI TAKUMI
YOKOYAMA TOMOMITSU
FUJITA MASAAKI

(54) SERVICE LIFE MONITORING DEVICE FOR PRESSURE RESISTANT PART

(57)Abstract:
PURPOSE: To operate the consumption life of a ligament part quantitatively in accordance with the behavior of an actual machine immediately by a method wherein the thermal stress, the range of maximum stress, the fatigue damage rate and the creep damage rate of the ligament part are operated by receiving the outputs of temperature sensors installed on the inner and outer surfaces of the ligament part.
CONSTITUTION: The temperatures of inner and outer surfaces of a ligament part 11 of the pressure resistant part 1 of a boiler and the temperatures of the inner and outer surfaces of a general part 12, at the opposite side of the ligament part 11, are measured momentarily to operate a stress in the ligament part by a thermal stress operating device 3. The operated data are sent into a range of stress operator 13 together with a stress, reserved in a memory 4, to obtain the range of maximum stress, then, the result is sent into a fatigue damage evaluating device 5 to operate the fatigue damage rate. On the other hand, an internal pressure is measured by a pressure sensor 6 to send it to an internal pressure stress operating device 7 to operate an internal pressure stress, then, the internal pressure is sent into a creep damage evaluating device 8 to operate a creep damage rate employing a creep breakdown curve.



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CLAIMS

[Claim(s)]

[Claim 1] The temperature sensor formed in the inside-and-outside side of this header ligament section of the heavy-gage pressure part which has a header ligament for a monitor, and the inside-and-outside side of the other general sections, A thermal stress count means to undergo the output of this temperature sensor and to compute the thermal stress of the above-mentioned ligament section, The memory connected with this thermal stress count means, and a stress range operation means to be connected with this thermal stress count means, and to compute the maximum stress range, A fatigue damage evaluation means to be connected with this stress range operation means, and to compute the rate of fatigue damage, The pressure sensor formed in the above-mentioned heavy-gage proof-pressure circles, and an internal pressure stress count means to undergo the output of this pressure sensor and to compute internal pressure stress, A creep damage evaluation means to be connected with this internal pressure stress count means, and to compute the rate of creep damage, Life supervisory equipment of the pressure part characterized by coming to have the adder which undergoes the output of the above-mentioned fatigue damage evaluation means and a creep damage evaluation means, and a life consumption operation means to undergo the output of this adder and to output life consumption.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the life supervisory equipment of the pressure part of high affable meat, such as a booster heater header of a boiler, and a reheater header.
[0002]
[Description of the Prior Art] Conventional life supervisory equipment measured the temperature of - external surface among the general heavy-gage pressure-part sections, such as a boiler, calculated thermal stress after this, and was performing only the life monitor of the general section.
[0003]
[Problem(s) to be Solved by the Invention] According to the knowledge in the latest West, it is known increasingly that the damages on a boiler heavy-gage pressure part will occur frequently not in the general section but in the ligament section (tube-hole penetration section). Under the monitor which observed the above-mentioned conventional general section, there was anxiety in dependability.
[0004]
[Means for Solving the Problem] This invention adopts the following means in order to solve the above-mentioned technical problem.
[0005] Namely, the temperature sensor formed in the inside-and-outside side of this header ligament section of the heavy-gage pressure part which has a header ligament for a monitor, and the inside-and-outside side of the other general sections as life supervisory equipment of a pressure part, A thermal stress count means to undergo the output of this temperature sensor and to compute the thermal stress of the above-mentioned ligament section, The memory connected with this thermal stress count means, and a stress range operation means to be connected with this thermal stress count means, and to compute the maximum stress range, A fatigue damage evaluation means to be connected with this stress range operation means, and to compute the rate of fatigue damage, The pressure sensor formed in the above-mentioned heavy-gage proof-pressure circles, and an internal pressure stress count means to undergo the output of this pressure sensor and to compute internal pressure stress, The adder which undergoes the output of a creep damage evaluation means to be connected with this internal pressure stress count means, and to compute the rate of creep damage, and the above-mentioned fatigue damage evaluation means and a creep damage evaluation means, and a life consumption operation means to undergo the output of this adder and to output life consumption are established.
[0006]
[Function] Setting to the above-mentioned invention, a temperature sensor is the

temperature T2 of the inside of the header ligament section for a monitor, and the outside temperature T1, respectively. And temperature T four of the inside of the general section and outside temperature T3 are outputted. A thermal stress count means inputs these and computes the thermal stress sigma of the ligament section by the formula (1).
[0007]
[Equation 1]

$$\sigma = K_1 E\alpha (T_1 - T_2) + K_2 E\alpha \{ (T_1 - T_2)/2 - (T_3 + T_4)/2 \} \quad \cdots\cdots\cdots \quad (1)$$

ここで

E；ヤング率

α；線膨張係数

K_1；リガメント部内・外面温度差に関する応力集中係数

K_2；リガメント部と一般部の温度差に関する応力集中係数

[0008] This thermal stress is memorized by memory.
[0009] A stress range operation means measures the thermal stress newly calculated with the thermal stress count means, and the thermal stress in memory, asks for the maximum stress range, and sends it to a fatigue damage evaluation means. A fatigue damage evaluation means computes the rate of fatigue damage from this input. On the other hand, an internal pressure stress count means undergoes the output of a pressure sensor, computes internal pressure stress, and sends it to a creep damage evaluation means. A creep damage evaluation means computes the rate of creep damage from this input. An adder adds the rate of fatigue damage, and the rate of creep damage, and sends them to a life consumption operation means. A consumption operation means computes the life consumption for a monitor from this input.
[0010] Since the consumption life is based on the behavior of the system and is quantitatively computed paying attention to the ligament section most made into the lifting or the cone in damage by the heavy-gage pressure part as mentioned above, structure dependability, such as a boiler which has a heavy-gage pressure part, improves.
[0011]
[Example] Drawing 1 explains one example of above-mentioned this invention.
[0012] A thermocouple 2 is attached in the inside-and-outside side of the ligament section 11 of the heavy-gage pressure part 1 of a boiler, and it is tied to thermal stress count equipment 3. Moreover, a thermocouple 2 is similarly attached in the inside-and-outside side of the general section 12 of the opposite side, and it is tied to thermal stress count equipment 3. Furthermore a pressure sensor 6 is attached and it is tied to internal pressure stress count equipment 7. Memory 4 is connected with thermal stress count equipment 3. The output of thermal stress count equipment 3 is sent to an adder 16 through the stress range computing element 13 and fatigue damage evaluation equipment

5 one by one. Moreover, the output of internal pressure stress count equipment 7 is sent to the life consumption computing element 9 through creep damage evaluation equipment 8 and an adder 14 one by one.

[0013] The temperature of - external surface is measured every moment among the ligament sections 11 of the boiler pressure part 1 above among the general sections 12 of - external surface and its opposite side. These are transmitted to thermal stress count equipment 3, and the stress of the ligament section is calculated by the above-mentioned formula (1). In addition, the stress-concentration factor K1 in a formula and K2 Since it is the multiplier decided by configurations, such as a hole pitch of the ligament section, and the number of tube holes, beforehand, it calculates and chart-izes, builds about the configuration assumed, and enables it to correspond to various dimensions immediately. The calculated stress is saved in memory 4. And it is sent to the stress range computing element 13 with the stress saved in memory 4 whenever stress is calculated newly, and is compared there, and the maximum stress range is called for. This is sent to fatigue damage evaluation equipment 5, and the rate of fatigue damage is computed using the fatigue curve built in here.

[0014] On the other hand, internal pressure is measured with a pressure sensor 6, and is sent to internal pressure stress count equipment 7. Internal pressure stress count equipment 7 calculates internal pressure stress from an input, and sends it to creep damage evaluation equipment 8. With creep damage evaluation equipment 8, the rate of creep damage is computed using an input and the built-in creep rupture curve. These rates Df of fatigue damage Rate Dc of creep damage It is added with an adder 14 and sent to the life consumption computing element 9 as a rate D of creep fatigue damage. And the operation output of 9s of the life consumption of a boiler pressure part is carried out.

[0015] Since ****** is based on the behavior of the system and is quantitatively computed paying attention to the ligament section most made into the lifting or the cone in damage by the heavy-gage pressure part as mentioned above, structure dependability, such as a boiler which has a heavy-gage pressure part, improves.

[0016]

[Effect of the Invention] Since according to this invention the consumption life is based on the behavior of the system and is most computed quantitatively in damage by the heavy-gage pressure part paying attention to the ligament section made into the lifting or the cone as explained above, structure dependability, such as a boiler which has a heavy-gage pressure part, improves.